UTILIZATION OF WOODY PLANTS BY BEAVERS IN NORTHEASTERN OHIO[1]

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ABSTRACT

Relative abundance of woody plants and their utilization by beavers (*Castor canadensis*) were measured on watersheds in Ashtabula and Columbiana Counties, Ohio, in 1966–67. A food index showed aspen (*Populus* sp.), alder (*Alnus* sp.), hop-hornbeam (*Ostrya virginiana*), black cherry (*Prunus serotina*), willow (*Salix* sp.), dogwood (*Cornus* sp.) and oak (*Quercus* sp.) to be major foods; 20 different woody species were utilized. The amount of use of a single species seemed to depend largely on the relative availability of all food species. All topographic features may influence site occupancy by beavers, but in this study, fluctuating water level was the factor most detrimental to sustained habitation.

After being exterminated in Ohio by 1830 (Chapman, 1949, p. 174), beavers were reported reappearing in the state in 1936 in counties bordering Pennsylvania (Bednarik, 1965). Since then, they have exerted considerable local influence on streams and watersheds of the area. This study was undertaken to determine utilization of woody vegetation and characteristics of sites occupied by beavers on certain watersheds of northeastern Ohio. Information on the influence of beavers on habitat, in addition to data on beaver productivity (Henry and Bookhout, 1969), is necessary for practical beaver management on a sustained yield basis.

THE STUDY AREA

Ashtabula and Columbiana Counties were chosen for examination, primarily because they contained sizeable beaver populations at the time of the study. They also occupy two distinct forest and physiographic regions (Braun, 1961, p. 19–20, 24). Ashtabula County, within the Beech-Maple Forest Region, is dominated by beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) on the better sites, while extensive mixed stands of black ash (*Fraxinus nigra*), white ash (*F. americana*), elm (*Ulmus* sp.), and red maple (*Acer rubrum*) occur in the depressions and intermorainal flats. Southern Columbiana County lies within the Mixed Mesophytic Forest Region; major canopy trees are beech, tuliptree (*Liriodendron tulipifera*), sugar maple, basswood (*Tilia* sp.), red oak (*Quercus borealis*), white oak (*Q. alba*), red elm (*Ulmus rubra*), and black cherry (Braun, 1961: 21).

MATERIALS AND METHODS

Overlays were prepared from maps of locations of beaver colonies provided by the Ohio Division of Wildlife. An attempt was made to locate three types of colonies: (1) those less than three years old, (2) those in existence for at least five years, and (3) those permanently abandoned within the last two years. Permanently abandoned colonies could not be located, but four colonies of each of the remaining two types were selected for habitat surveys. Colonies less than three years old were located in New Lyme and Cherry Valley Townships, Ashtabula County, and in Wayne and Madison Townships, Columbiana County; colonies more than five years old were located in Andover and Cherry Valley Townships, Ashtabula County, and in Wayne Township, Columbiana County.

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On each area selected for study, eight belt transects, each one foot wide, were established for each 25 yards of stream use, four on either side of the stream. Transect locations were selected at random within each stream segment, established at right angles to the general direction of stream flow, and continued away from the stream for 50 yards or to the edge of observed utilization. Each transect was divided into 15-foot segments, in order to determine vegetational change with distance from the stream. Because utilization of an area by beavers is not uniform, a certain degree of randomness was sacrificed to assure a representative sample. About five percent of the total area of each colony was sampled.

Transects were examined during August and September of 1966 to determine the woody plant composition at each colony site. Total counts were made of all woody species present. Each basal stem was placed in a diameter class, but no attempt was made to estimate the quantity of food present or the amount used per beaver. Transects were examined again in April, 1967, to measure utilization during the intervening winter period. All woody species cut or in any way utilized were tallied by diameter class.

RESULTS AND DISCUSSION

Woody Plant Composition

A total of 28 woody plant species occurred in the belt transects, 22 in Ashtabula County and 24 in Columbiana County. Of the 13 species comprising more than 1.0 percent of the total basal stems in Ashtabula County, 10 also were present in Columbiana County (Table 1). This indicates that the same species generally occur along the water courses studied in both counties, though with different frequencies. Nearly 50 percent of the basal stems at colonies in Ashtabula County were composed of aspen and willow. In contrast, aspen made up only 3.1 percent of the basal stems and willow was absent from the colonies surveyed in Columbiana County; serviceberry (13.5 percent), dogwood (12.7), hawthorn (12.6), and black cherry (11.7) comprised more than 50 percent of the basal stems at colonies there (Table 1). Differences in vegetational composition could not be detected among colonies of the age groups selected. For this reason, and because naturally

TABLE 1

Woody plants associated with beaver colonies in Ashtabula and Columbiana Counties, Ohio, 1966[1]

Ashtabula County		*Columbiana County*	
Species	Percent Composition	Species	Percent Composition
Willow	35.3	Serviceberry (*Amelanchier arborea*)	13.5
Aspen	13.3	Dogwood	12.7
Dogwood	11.1	Hawthorn	12.6
Choke Cherry (*Prunus virginiana*)	5.9	Black Cherry	11.7
Red Maple	5.0	Ninebark (*Physocarpus opulifolius*)	8.1
Alder	4.7	Elm	7.2
Hawthorn (*Crataegus* sp.)	4.5	Oak	6.8
Hop-hornbeam	4.0	Red Maple	5.2
Hickory (*Carya* sp.)	3.6	Alder	4.2
Oak	3.1	Hop-hornbeam	3.8
Apple (*Pyrus malus*)	2.2	Aspen	3.1
Elm	1.9	Black Locust (*Robinia pseudo-acacia*)	2.8
Black Cherry	1.5	Hickory	2.1
		Witch-hazel (*Hamamelis virginiana*)	1.3

[1]Species occurring in sample plots in both counties and comprising 1.0 percent or more of all basal stems present.

abandoned colony sites could not be located, rate and trend of vegetational change at occupied sites could not be determined.

Woody Plant Utilization

Beavers feed on a variety of woody plants, and less favored foods may be cut even when favored species are at hand. Some investigators place utilized species on a preference scale. However, the plant most frequently utilized is not necessarily most highly preferred; the amount of utilization is dependent upon other factors, such as relative availability and stem diameters of species present, distance of plants from water, and immediate topography of the area. The food index of Hungerford (1957) was used to express utilization of woody plants by beavers (Table 2). This index expresses utilization and availability as percentages:

$$\text{Food Index} = \frac{\%\ \text{utilization} \times (100 - \%\ \text{availability})}{100}$$

It was assumed that all stems cut were utilized in some manner as food and not entirely for dam construction.

Twelve of 22 (54.5 percent) woody species available were utilized in some manner at colony sites sampled in Ashtabula County; 13 of 24 (54.2 percent) species available were utilized in Columbiana County. Five utilized species were common to both counties: aspen, oak, alder, dogwood, and hop-hornbeam. Of these, only aspen (16.3, 14.8) and dogwood (5.4, 6.3) ranked similarly in the food indices of the two counties (Table 2). Aspen, though utilized heavily in both

TABLE 2

Relative amounts of woody plants utilized by beavers in northeastern Ohio, 1966

Species	Percent Availability	Percent Utilization[1]	Food Index[2]
	Ashtabula County		
Alder*	4.7	24.8	23.7
Aspen*	13.3	18.8	16.3
Hop-hornbeam*	4.0	13.9	13.4
Ash	1.0	6.7	6.6
Willow	36.3	9.1	5.9
Dogwood*	11.2	6.1	5.4
Hickory	3.6	5.5	5.3
Oak*	3.1	4.2	4.1
Tupelo (*Nyssa sylvatica*)	Trace	3.0	3.0
Beech	0.6	3.0	3.0
Apple	2.2	2.4	2.4
Red Maple	5.0	2.4	2.3
	Columbiana County		
Black Cherry	11.7	19.8	17.5
Aspen*	3.1	15.1	14.8
Oak*	6.8	13.5	13.6
Hawthorn	12.6	10.8	9.5
Witch-hazel	1.3	7.2	7.1
Alder	4.2	7.2	6.9
Dogwood*	12.7	7.2	6.3
Ironwood (*Carpinus caroliniana*)	0.6	5.4	5.4
Basswood	0.4	4.5	4.5
Hop-hornbeam*	3.7	4.5	4.3
Elm	7.2	1.8	1.7
Ninebark	8.1	1.8	1.7
Black Locust	2.8	0.9	0.9

[1]No. of stems utilized of a given species/total no. basal stems utilized.
[2]Percent utilization×(100−percent availability)/100 (Hungerford, 1957).
*Species common to both counties.

counties, was present in much greater abundance at colonies in Ashtabula County. In contrast, alder and hop-hornbeam, present in both counties with nearly equal frequencies, were much higher in the food index for Ashtabula County. This demonstrated the importance of relative availability to utilization. Oak (mostly *Quercus bicolor* and *Q. borealis*), not commonly listed as a preferred beaver food, was high on the food index for Columbiana County and was utilized primarily in the absence of more preferred species.

Stem diameter may influence beaver use of woody plants. In the colonies sampled, 83 to 91 percent of the woody species were 3 inches or less in diameter (Table 3), a factor favorable for beaver occupancy. Bailey (1927) stated that trunks of more than 5 inches are rarely cut or removed from where they fall. According to Bradt (1938), the average diameter of trees cut in Michigan was 2.1 inches. In the present study, about 90 percent of all stems used were in the 0–3-

TABLE 3

Frequency of diameter classes of woody plants at sites occupied by beavers in northeastern Ohio, 1966

County	Diameter Class (inches)	Percent Composition	Percent Utilization
Ashtabula	0–3	90.9	89.7
	3–7	6.9	9.1
	7–10	1.6	1.1
	10 and over	0.6	Trace
Columbiana	0–3	83.4	91.3
	3–7	10.4	5.8
	7–10	4.3	2.7
	10 and over	1.9	Trace

inch-diameter class, and only 6–9 percent were from 3 to 7 inches in diameter. There are, of course, exceptions to the general pattern. In one instance, a beaver had traveled more than 500 feet along a wooded slope to cut and completely remove a lone, 10-inch bigtooth aspen (*Populus grandidentata*). No other trees along the path were cut, although other commonly utilized species were present.

In general, beavers in northeastern Ohio utilize a variety of woody plant species and the amount of use given a species depends largely on stem diameter and relative availability.

Colony Characteristics

Beaver habitat in northeastern Ohio is almost entirely in private ownership. Although the sustaining food items are woody plants, agricultural crops may be utilized when available. At one colony site (Wayne Township, Columbiana County), beavers had removed several stalks of corn form a small cornfield adjacent to the stream. Herbaceous vegetation, including a variety of aquatic and semi-aquatic plants, is used during the summer months (Bradt, 1938, p. 28), but its use was not measured in the present study.

Regardless of the extent of woody vegetation, utilization seldom occurred farther than 50 to 75 yards from the stream or pond. Feeding activity extended along streams for variable distances, depending upon availability of food species. Steep gradients of mountain streams often necessitate several dams to extend the feeding range of beavers. In the area we studied, however, stream gradient seldom exceeds one percent, and a single dam may back up water for several hundred yards. Deep, slow moving streams which characterize some Ohio watersheds permit free movement of beavers up- and downstream for extended distances.

Typical beaver houses were present at all colonies studied and usually were accompanied by one or more bank dens. Food caches of varying size also were evident at each of these colonies.

Effects of Fluctuating Water Levels

Although the more prominent topographical features, such as steepness of adjacent slopes, width of the flood plain, and stream gradient, can influence site occupancy by beavers, seasonal variation in water depth was a major factor influencing distribution in Ohio. For example, two of the eight colonies selected for study were abandoned over the winter period. One was located on an intermittent stream. By late September, the stream was nearly dry, and the water level in the pond had become considerably lowered. The following spring survey showed no winter utilization. The site apparently was abandoned in early winter but was reoccupied by early June. The second abandoned colony received some winter use, but high water in late February washed out the single dam. The colony was not reoccupied the following spring. The single dam was washed out at a third colony site, but beavers remained in the immediate vicinity, apparently living in established bank dens. At this site, stands of alder were accessible when stream levels were high, but were 200 to 250 feet from the water in late summer.

MANAGEMENT IMPLICATIONS

A primary consideration in any program of beaver management is the influence of beavers on plant growth and succession. The present study showed that beavers in northeastern Ohio utilized a variety of woody plants and that use of one woody species was at least partially dependent upon the availability of others. In no instance was a colony site abandoned as a result of over-utilization of the food resource. The use of woody plants was on an essentially sustained-yield basis, although this may not have been true for certain species. Streamside vegetation, particularly, withstood continued use without noticeable injurious effects. Results of this study indicated that fluctuating water level was the most important factor influencing sustained beaver habitation of a given site.

A need for increased exploitation of the beaver population by more liberal trapping regulations was not indicated. Thus it is likely that complaints of beaver damage to crops and roadways from impounded water will dictate the necessity for beaver control before habitat deterioration occurs.

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